Minutes of the Fifth Meeting
of the
HIPPARCOS SCIENCE TEAM
ESTEC, 2-3 December 1982

Attendance

HST: Dr. M.A.C. Perryman, Chairman
Dr. P. Brosche (part time)
Dr. C. Coleman
Prof. F. Donati
Dr. M. Grenon
Dr. E. Høg
Prof. J. Kovalevsky
Dr. L. Lindegren
Mr. C.A. Murray
Mr. R.S. Le Poole
Dr. C. Turon
Prof. C.G. Wynne

ESA: Mr. L. Emiliani
Mr. R. Bonnefoy
Mr. M. Schuyer
Dr. S. Vaghi
Dr. R. Wills
Mr. H. Laue (ESOC)

1. Adoption of the Agenda

The agenda as shown in Annex 1 was adopted.

2. Report by Project Manager

Emiliani reported on the continuing B 1 activities. Phase C/D was expected to start in mid July 1983. Updated issues of the ESA SRD and the B2-C/D SOW had been released, and these were distributed to the HST.

3. Observing Proposal Selection

The meeting of the Selection Committee (composition given in Annex II) would take place in Paris on December 16-17. A total of 197 proposals had been

received (see Annex III) and the data was now in Meudon.

4. Status Report by Project Scientist

4.1. Reports from ICC/NDAC/FAST were received by ESA at the end of October.

4.2. The process of ensuring information exchange within and between the various HIPPARCOS Consortia was still evolving; Perryman distributed to the consortia leaders a routine that he proposed to follow in the future. This proposal was considered acceptable by the consortia leaders (see Annex IV).

4.3. Bonnefoy gave details of the meeting on the holographic grid developments with RAL held on 10 November. A report would be distributed to the HST in the near future. Meanwhile CEH would continue work on the EBL technique. Kovalevsky distributed a note on the induced phase errors as a result of grid stitching by Froeschle. Le Poole reported that a sample of the grid under development at TPD could be available by the end of the year.

4.4. Grid Optimisation

Kovalevsky had reported results of studies by FAST which confirmed the values of the grid parameters proposed by MATRA.

4.5. Transformation of Coordinates

At a meeting held in ESTEC on 9 November, a text was agreed by the scientific consortia, MATRA and ESA. This text had now been incorporated into the SRD. Actions to confirm requirements are being undertaken by the data analysis consortia.

4.6. Veiling glare

At the meeting on 9 November, it was proposed that a reduction in the IFOV size could lead to reduced perturbations. Meanwhile ESA would provide a quantitative IFOV model to the scientific consortia to allow INCA to assess the feasibility of exploring the region surrounding programme stars.
Wynne commented that the IDT relay optics appeared to be rather complex. Further assessment would be undertaken by Wynne.

4.7. Chromaticity

Turon presented results of INCA's analysis of the availability of photometric

information from the CSI (Annex V). Kovalevsky and Lindegren outlined possible ways in which the chromaticity problem could be handled in the data analysis stage. The introduction of star colours into the data analysis would depend on the form of the chromaticity map - this would be more straightforward the fewer distortion parameters are colour dependent. The goal should be to have as many programme star colours as possible available to the data analysis consortia before launch. The consequences of this approach would be assessed by Turon.

5. Discussion of SSDR Documentation

The documents listed in the Agenda had been distributed to the HST; comments on them are summarized as follows (see also Annex VI):

5.1. Observing Strategy

Kovalevsky stressed the disadvantages of the observing strategy proposed by MATRA. These include its inflexibility, its reduced rigidity because of the reduced 'effective' field of view, and its disadvantages for dynamical smoothing (bright stars cannot be observed at the start and end of the FOV transit).

5.2. Star Mapper

Kovalevsky expressed his concern with the present star mapper design. Inclined slits (only) would give problems with the RTAD, a view shared by the Project Team. By including vertical slits, possibly up to the height of the FOV, RTAD capability would be improved, as would TYCHO astrometry and photometry. OGAR precision would deteriorate however, and TYCHO confusion would be worsened. Concerning the former problem, both consortia leaders considered that 0.15 arc sec rms precision in OGAR was acceptable (cf 0.1 arc sec in the ITT), and now that TYCHO analysis was also based on 'Input Catalogue' the latter problem was less severe. Both consortia leaders agreed that the original SM design (vertical plus inclined slits), but with aperiodic spacing, should now be adopted.

Kovalevsky suggested inclusion of a broad grid in the main FOV to aid solution of grid step ambiguity. This would probably no longer be useful if the vertical SM slits are adopted. Høg proposed that the 20 arc sec gap in the SM chevron slits be reduced to 10 arc sec.

5.3. IDT Spectral Coverage

Høg proposed to include light shortward of 380 nm in the IDT to improve photon statistics, given the present throughput of the system in this range. Kovalevsky noted the problems with chromaticity. Grenon noted that the resulting photon flux for a typical B-V ∿ 0.5 mag star would be only some 30 percent greater than at present.

5.4. MTF Increase

Kovalevsky introduced the proposal by Le Gall et al. to mask the entrance pupil and herce increase the telescope MTF. (Lindegren suggested that an alternative was to mask the IDT relay optic pupil, and hence preserve the TYCHO photon statistics. Bonnefoy commented that consequent alignment tolerances could be tight, with refocussing possibly causing problems). Lindegren commented that the gain in the MTF was not so dramatic (perhaps only 1-2 per cent) if a more realistic polychromatic MTF was assessed.

5.5. TYCHO Specifications

Wills presented the original (DCN) version of the TYCHO specifications, and the proposed revision of the specifications in terms of astrometric and photometric performance at ½ (B+V) = 9.65 mag (instead of B = 10 mag) and B-V = 0.7. Extreme colour ranges of B-V = 0.0 mag to B-V = 1.5 mag should be used for TYCHO specifications, because of the expected distribution of star colours encountered by TYCHO.

HST members supported this approach. It was furthermore confirmed that the astrometric requirement of 0.1 arc sec should refer to the longitudinal grid coordinate (and not the "coordinate perpendicular to the slit"). In the case of inclined slits, attitude uncertainties would need to be taken into account in the formulation of the error budget.

Grenon fully supported the proposed TYCHO approach, and recommended that this formulation be adopted for the main mission also. At least the limiting magnitude at a redder colour should be specified. Grenon also proposed that the SM design be optimised with respect to astrometry and photometry of faint stars.

5.6. Accuracy Specifications

As methods for MESH to reach the original mission objectives, increasing the mission lifetime was proposed by Le Poole, and the idea of increasing

the FOV size by Bonnefoy was supported by Høg.
The Great Circle Reduction (iterative) method proposed by Burrows was not considered to be a valid means to reduce abscissae errors; this approach was known to both data analysis consortia, but would not be adopted by either of them.

5.7. Photometric Aspects

Grenon considered that absolute photometry to 20 per cent was unsatisfactory, and it was agreed that the overall throughput should be known with an accuracy consistent with the current predicted margin.

Kovalevsky draw attention to a possible mistake in the formulation of IDT photocathode blemish specifications (Detection SS Specification p 34). The Project Team would check this specification.

Grenon proposed that the 3 calibration wavelengths considered by MATRA should be 425-550-650 nm and not 425-550-675 nm because of atmospheric lines at around 675 nm. The 50 nm bandwidth should remain unchanged.

Grenon emphasized the importance of temperature stability for the dichroic beam splitters and for the photomultiplier photocathodes, especially for S-11 where $\pm$ 0.5^{o} C is necessary. The problem of filter aging should also be considered.

The photomultiplier choice was still being studied. Grenon noted that selection of an S-11 would allow Johnson BV to be well matched. This was considered desirable, a channel overlap of some 50 per cent could be tolerated. Grenon and Le Poole stated that no long-wavelength blocking filter should be introduced into the TYCHO V channel. An extended red sensitivity was scientifically valuable, although this should be traded off against photocathode dark noise.

5.8. Downlink Telemetry

Høg asked that the downlink telemetry should contain the SM records for all programme stars, not only the normal SM stars, in parallel with the TYCHO stream. The Project believed that MATRA presently anticipate to send only the TYCHO stream from the SM, not with (redundant) attitude information. Further investigation would be made by the Project Team.

5.9. BOS

Coleman drew attention to inadequacies in the present BOS design, in particular proposing that the HV supply should be shut off when the BOS is activated.

5.10. Spin Axis

Høg noted that the reversal of the spin axis was foreseen during commissioning in the Overall System Specification. This flexibility would be valuable in assessing fluctuations in the basic angle, and proposed that this facility was available also during the operational phase. Emiliani was not in favour of introducing this as a requirement to MATRA. Høg further noted that the 0.5 arc sec knowledge of the basic angle at the end of commissioning should be added to the IDT piloting error budget accounted for by MATRA.

5.11. TYCHO U-Filter

An updated proposal was introduced by Høg, and letters of support from Dr. Knude (Copenhagen) and Drs. Guibert & Egret (France) had been received. Grenon presented arguments in favour of the U-band option (determination of reddening, discovery of F-K metal-poor stars) and against it (presence of Michigan survey, decrease in value of BV variability programmes). Bonnefoy presented the technical impacts (mirror coating trade off, relay lens design, testing aspects in the UV, additional analysis of the chromaticity and knife-edge function of the SM). Emiliani advised against including the U-band option from a programmatic viewpoint. Finally there was full agreement not to consider the proposal further.

5.12. TYCHO Input Catalogue

Murray reported the probable cooperation of the STScI in providing the TYCHO consortium with a complete 'input catalogue'. The contract point was Dr. J. Russel. A formal letter was expected in the near future.

6. ESOC Quick Look Facility

Laue introduced the subject and invited suggestions for such a facility.

It was considered desirable to reduce each great circle, or possibly 1 GC every 1-2 days, largely in real-time and for as many instrumental parameters as possible - e.g. basic angle, distortion parameters, etc. Any significant verification should aim for an accuracy comparable to the final accuracy expected.

As a means of reducing computations, the residuals could be monitored, rather than the full solution being computed. This should aim to monitor stability without solving the full solutions. At the same time simplified phase extraction methods could be employed.

Monitoring of the IDT and the SM data should also be performed at ESOC. The DRC proposed that quality checks, improved parameters, etc. should come from them, and should be fed back to ESOC on a weekly basis.

The Project Team in collaboration with ESOC would formulate an initial proposal within approx. 3 months, taking these ideas into consideration.

7. Public Relations Activities

ESA would hope to publish a brochure on HIPPARCOS for the general public, and the HST were invited to propose ideas, material, etc. for inclusion in such a document. Kovalevsky proposed that informative diagrams were also made available.

8. Coordination of Software & Simulation Tasks

A model Input Catalogue had been generated by M. Mennessier (Montpellier) and this would be distributed to ESA and the DRC by Turon in the near future.

Kovalevsky reported FAST's simulation work. Counts on a great circle based on a detailed satellite model were expected in mid-1983, and these would be distributed to interested groups at that time.

Kovalevsky distributed FAST's software and tape format guidelines. Perryman would distribute the ESA software standard to the three consortia, and a meeting would be planned by ESA in early 1983 to discuss these issues in further detail.

9. Next Meeting

A meeting of either the HST, or the Consortia leaders, would take place in about March 1983.

Fifth Meeting

of the

HIPPARCOS SCIENCE TEAM

2-3 December 1982

AGENDA

Status Report (L. Emiliani)

Proposal Selection Committee activities

Agenda for Future Meetings

Status of Actions from Preceeding Meetings:
- Consortia Reports to ESA
- Documentation/exchange of information
- Modulating grid (RB)
- Grid optimisation (FAST)
- Transformation of coordinates (meeting of 9-11-82)
- Veiling glare status and actions from 9-11-82
- Chromaticity status and actions from 9-11-82
- Star mapper requirements (with INCA)

SSDR: Distribution of SRD and B2-C/D SOW

Discussion of:

- Overall System Technical Report	120 min
- Payload Subsystem Technical Report	60 min
- Accuracy Report	60 min
- Overall System Specification	60 min
- Payload System Specification	60 min
- AOCS, Detection & Optics Subsystem Specs	30 min
- Accuracy Verification Master Plan	30 min

Discussions to include:
- frame time (E. Hoeg)
- observing strategy (J. Kovalevsky)
- Burrows' paper on iterative approach to GCR
- MTF increase (J. Le Gall)
- status of TYCHO specifications (R. Wills); TYCHO proposal and ST ScI involvement; U-filter option (E. Hoeg)
- star mapper design (RTAD, TYCHO)
- telemetry of attitude data (E. Hoeg)

Any other business

HIPPARCOS

Committee for the Selection of Observing Proposals

A. Blaauw (Chairman)
J. Dommanget
W. Gliese
M. Hack
E.P.J. van den Heuvel
C. Jaschek
J. Lequeux
P.O. Lindblad
A. Maeder
P. Nissen
B.E.J. Pagel
A. Renzini
Ch. de Vegt
P.A. Wayman
R. Wielen

Annex III

To follow Selection Committee Meeting

HIPPARCOS - EXCHANGE OF INFORMATION

1. The Project Team wishes to encourage the Scientific Consortia to forward working papers or technical notes to the HIPPARCOS Project, via the PS, thus allowing the Project Team to follow the evolution of ideas within the Consortia and hence to ensure that the industrial development is compatible with, and takes full advantage of, such ideas.

2. The Project Team has no prejudice against 'inter-consortia' correspondence, exchange of notes, etc. The following remarks are made: (a) such exchanges should still aim to preserve the independence of the work of the two data analysis consortia; (b) copies of such exchanges, at the discretion of the Consortia Leaders, are welcomed by the Project Team for the reasons set out in (1) above.

3. Correspondence to the PS is circulated to the Project Team, at the discretion of the PS; direct correspondence with the Project Team members is left to the discretion of the Consortia Leaders. Similarly, occasional direct contact with consortia members by the PS is accepted by the Consortia Leaders.

4. Direct communications between consortia members and industry is considered undesirable, other than in the context of the work of the SAG.

5. Correspondence, working notes, etc. submitted to the PS for information will be considered as available for further distribution to members of the Project Team, to MESH, and to the other scientific consortia unless clearly stated on the document to the contrary. Such distribution will be at the discretion of the PS.

6. Exceptions to (5) will be the 3-monthly reports submitted to ESA, and minutes of consortia meetings, which will not be distributed to the other scientific consortia.

7. All documents logged by PS and the Project Team will appear in the HIPPARCOS documentation list. Every 3 months, coinciding with the Consortia reports to ESA, a supplement to the list will be sent to the Consortia Leaders, along with copies of papers considered by PS to merit automatic distribution. Documents will not be distributed by default - if one consortia wishes to receive all papers generated by another, the necessary arrangements should be made between them directly.

8. Distribution of information made available to Consortia Leaders within the Scientific Consortia is the responsibility of the Consortia Leaders. Any information made available to the Consortia Leaders may be distributed within the relevant consortia, unless explicitly stated to the contrary.

9. Requests from consortia for MESH/ESA documentation appearing in the documentation list should be made by Consortia Leaders to PS.

10. Requests from consortia for papers generated by the other scientific consortia, and not distributed as part of the 3-monthly cycle, should be made to the relevant Consortia Leaders.

Statistiques photométrie CSI

Annex V

434 000 *

Magnitudes visuelles

limites	B et V	B: et V	V seul	V: seul	B: et V:	B et V:	Total
V ≤ 6	5177 95%	241 4	5 0.1	17 0.3	6 0.1	12 0.2	5458
V ≤ 9	110 044 74%	16 086 11	60 0.04	5221 3.5	191 0.1	16 980 11	148 582
V ≤ 13	205 808 52%	38 566 10	843 0.2	30 411 8	3325 0.8	118 332 30	397 285

limites	$\sigma_V \leq 0.3$	$\sigma_V \geq 0.4$	$\sigma_{B-V} \leq 0.4$	$\sigma_{B-V} \geq 0.5$	pas B-V	∈ ADS IDS	∈ Kukarki
V ≤ 6	5423 99.4%	35 0.6	5177 95%	259 5	22 0.4	1872 34%	190
V ≤ 9	126 190 85%	22 392 15	110 044 74%	33 257 22.4	5281 3.6	18 064 12%	897
V ≤ 13	245 217 62%	152 068 38	205 808 52%	160 223 40	31 254 8	40 069 10%	1946

Magnitudes bleues

limites	B et V	B: et V	B: et V:	B et V:	B seul	B: seul	Total
B ≤ 6	3138 94.3%	152 4.6	4 1.2	2 0.06	0	32 1	3328
B ≤ 9	64 895 86	8146 11	267 0.4	1488 2	97 0.1	734 1	75 627
B ≤ 13	205 050 52.7	38 558 10	3311 0.9	118 231 30.4	2750 0.7	21 354 5.5	389 254

limites	$\sigma_B \leq 0.3$	$\sigma_B \geq 0.4$	$\sigma_{B-V} \leq 0.4$	$\sigma_{B-V} \geq 0.5$	pas de B-V	∈ ADS IDS	∈ Kukarki
B ≤ 6	3140 94%	188 6	3138 94.3	158 4.8	32 1	1368 41%	124 4
B ≤ 9	66 480 55%	3147 12	64 895 86	9901 13	831 1	12 746 17%	512 0.7
B ≤ 13	326 031 83.8%	63 223 16.2	205 050 53	160 100 41	24104 6	31 212 8%	2098 0.5

Nombre d'étoiles sans B ni V : 7742 * soit 1.8 % du CSI

" " sans B : 41 217 * soit 9.5% du CSI

" " sans V : 33 143 * soit 7.6 % du CSI

Statistics on photometry in the CSI

limits	$\sigma_B \leq 0.3$	$\sigma_B \geq 0.4$	$\sigma_{B-V} \leq 0.4$	$\sigma_{B-V} \geq 0.5$	no B-V
$B \leq 6$	94 %	6 %	94 %	5 %	1 %
$B \leq 9$	88 %	12 %	86 %	13 %	1 %
$B \leq 13$	84 %	16 %	53 %	41 %	6 %

Percentage of stars belonging to

- multiple star catalogues ADS, IDS
- variable star catalogues Kukarkin

limits	ADS IDS	Kukarkin
$B \leq 6$	41 %	4 %
$B \leq 9$	17 %	0.7 %
$B \leq 13$	8 %	0.5 %

in the CSI, 41 200 * with no B ($\sim$ 9.5 %)
among them: 7 800 * with no B and no V

Statistics on photometry in the Catalogue of Stellar Identification (CSI)

limits	$\sigma_V \leq 0.3$	$\sigma_V \geq 0.4$	$\sigma_{B-V} \leq 0.4$	$\sigma_{B-V} \geq 0.5$	no B-V
$V \leq 6$	99%	1%	95%	5%	0.4%
$V \leq 9$	85%	15%	74%	22%	4%
$V \leq 13$	62%	38%	52%	40%	8%

Percentage of stars belonging to

- multiple star catalogues ADS, IDS
- variable star catalogues Kukarkin

limits	ADS IDS	Kukarkin
$V \leq 6$	34%	3%
$V \leq 9$	12%	0.6%
$V \leq 13$	10%	0.5%

in the CSI, 33 200 * with no V ($\sim$ 7.6%)
among them: 7 800 * with no V, no B

esa estec

HIPPARCOS

MEETING HIPPARCOS

PLACE

REF. Annex VI

DATE

PAGE 1

ACTION No	DESCRIPTION (not more than 4 lines)	CLOSING DATE	ACTIONNEE Person/firm	INITIATOR Person/firm
1	HST to provide written comments on ESA dynamic smoothing specification if members are dissatisfied with present text.	10 Jan 83	HST	No comments came!
2	ESTEC to provide IFOV profile to NDAC/FAST/INCA on which to base their investigations detailed in Actions of 9-11-82. Delay action of 9-11-82 to 1-3-83 for V.G. actions.	24 Dec 82	R BONNEFOY	Provided as requested. ✓
3	Consideration of optimisation of IOT relay ~~lens~~ optics assembly with a view to increasing overall efficiency and decreasing size of IFOV.	1 March 83	C G. WYNNE	
4	Draft ESA/Consortia disposition on chromaticity approach, star colour availability etc. Telex to consortia leaders Wednesday 8 December. Response by consortia leaders to MAC by 10 December for input to MATRA SSDR Meeting.	8 Dec 82	MAC Reynaud	Telex sent and agreed upon.
5	~~Action~~ Check fundamental assumptions on energy distribution as a function of (B, B-V) as taken by ESA/MATRA.	1 March 82	M. CREZE	
6	Agree on SM requirements with MESH for initiation of INCA astrometric determination programme.	1 March 82	M. SCHUYER	
Signatures				

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MEETING HIPPARCOS

PLACE

REF.

DATE

PAGE 2

ACTION No	DESCRIPTION (not more than 4 lines)	CLOSING DATE	ACTIONNEE Person/firm	INITIATOR Person/firm
7	Data analysis consortia to provide their current estimates of the great circle reduction improvements and ~~great circle~~ coefficients of improvements (Section E.1.2.2.1 of ITT)	15 Feb 83 → 1 March.	E. Høg + J. Kovalevsky	
8	Determine range ~~over~~ of ultraviolet response which can be tolerated, and still allow precise transformation of HIPPARCOS magnitude to ground based systems, in view of the Balmer-discontinuity.	15 Feb 83	M. Grenon	
9	Distribution of preliminary (fictitious) version of Input Catalogue to ESA, FAST, NDAC.	ASAP	K. Tucon / FAST.	
Signatures				